

### **REMARKS**

In view of the above amendments and following remarks, reconsideration of the objections and rejections contained in the Office Action of October 4, 2006 is respectfully requested.

A substitute abstract is enclosed. However, it is noted that the abstract maintains the reference characters. It is submitted that it is common and indeed beneficial for reference characters to be contained in the abstract; the abstract does not need to be read independently of the drawings. Indeed, reference characters are required in International Applications.

A number of minor editorial changes have been made to the specification so as to generally improve the form thereof. Such changes include an amendment to the title and the remainder of the specification more clearly directing the disclosure toward the method that has been elected.

The Examiner's rejection of the claims under 35 U.S.C. §112, second paragraph is respectfully traversed. New claims have now been submitted clearly directed to a method. Further, claims 32-43 have been rewritten to address the Examiner's concerns as well as to generally reorganize the claims. No limitation of any of the claims is intended by the redrafting of the claims in their new form, however. Correspondingly, the apparatus claims have been redrafted as new claims 53-61.

As all issues raised by the Examiner in the Office Action have now been addressed, it is respectfully submitted that the application as a whole should be in condition for allowance. Indication of such is respectfully requested.

In view of the above amendments and remarks, it is submitted that the present application is now in condition for allowance, and the Examiner is requested to pass the case to issue. If the Examiner should have any comments or suggestions to help speed the prosecution of this application, the Examiner is requested to contact Applicants' undersigned representative.

Respectfully submitted,

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DESCRIPTION

**A METHOD OF FORMING [[SYSTEM TO FORM]] A LAYERING  
OF ELECTRONICALLY-INTERACTIVE MATERIAL**

The object of this invention ~~patent~~ is a method ~~system~~ for the  
5 formation of a layering of electronically-interactive material, ~~according to~~  
~~the characteristics of main claim.~~

Technical Field

By the term electronically-interactive material, we mean any kind of  
material which is capable of electronically interacting both in an active  
10 sense, such as through conductivity, or in a negative sense, such as through  
insulation, and does not exclude other parameters such as the typical on/off  
function which characterizes ~~characterises~~ micro-processors.

The invention is used preferably, but not exclusively, for the  
formation of a layering of electronically-interactive material, such as in: the  
15 manufacture of electronic circuit boards; the creation of screens with a layer  
of electronically-interactive material to project images from a flat screen to  
create displays, which may also be flexible, directly incorporating a  
computerized ~~computerised~~ system which does not exclude the function of a  
microprocessor with both organic and non-organic material, including the  
20 function of intelligence which may or may not be artificial, similar to  
cerebral functions, and also visualization ~~visualisation~~ or non-visualization  
~~non-visualisation~~ with different grades of variable luminosity materials by  
means of electronically induced phenomena which cover the entire range of  
the spectrum.

25 Background Art

According to the current state of the technology, the formation of a layering, either composed of a single layer or a number of layers, is carried out by either mechanical, chemical or photo-chemical methods. The techniques of layering with mechanical systems are slow and not very  
 5 suitable for the miniaturization ~~miniaturisation~~ and precision which modern electronic techniques need to acquire.

For example, in order to create electronic circuit boards, which is one of the main, although not exclusive, uses of this invention, either photographic or photo-engraving techniques are used, ~~and~~ which are far  
 10 superior to mechanical systems.

In spite of this, modern technology requires techniques which are more rapid and efficient, and which also have miniaturization ~~miniaturisation~~ and precision capacities superior to those achieved up until now, if possible.

15 It is well known that, even with photo-engraving techniques, since a photo-sensitive layer has to be engraved, it is not possible to create designs and miniaturized ~~miniaturised~~ circuits below a certain dimension. That is, it is not possible to go below certain values, which are determined by the minimum distance between two engravings, otherwise it would make the  
 20 thin layer between them unstable because, if it is too thin, it could be easily detached or ruined. As a general rule, an acceptable value for the ratio of the distance between one engraving and another and the thickness of the layer is  $>1$ . In fact, if the ~~said~~ ratio were less than 1, the height of the section of the layer would be greater than ~~then~~ the width, so the risk of breakage and a  
 25 resulting short circuit between two adjacent circuits would be high.

DE-19817530A discloses a process and device for the production of a thin-multilayer structure.

US-3661304 discloses a pressure impulse apparatus for initiating formation of fluid drops such as ink, in high speed printing, wherein the drops are  
 5 selectively placed on a paper web, providing a primary liquid supply at a constant pressure and starting means for applying ~~a an~~ higher pressure impulse, ~~the said~~ starting means including an auxiliary liquid supply.

#### Aim of the invention

The aim of this invention is to overcome the aforementioned  
 10 drawbacks and to allow a layer of electronically-interactive material to be rapidly and quickly formed on a surface, ~~having which has the~~ maximum precision even with the smallest of designs and ~~which has an~~ extremely low cost.

#### Explanation of the invention

15 The problem is overcome according to ~~the~~ characteristics described in ~~the main claim~~ below.

#### Advantages

The advantages obtained with the present invention ~~this~~ solution are the following:

- 20 - Speed of the process.
- Maximum simplicity.
- Maximum precision.
- Maximum miniaturization ~~miniaturisation~~ of the structures designed and integrated in the layer.
- 25 - Maximum reliability, safety, robustness and duration of the layering.

- Overall reduction of manufacturing costs.
- Respect for the environment with the elimination of all waste materials or pollutants.

Brief ~~[[Detailed]]~~ description of ~~[[an application]]~~ the drawings

5           These and other advantages will be shown in the following description and attached drawings of a preferential application of the solution according to the present invention, the details of which are intended to be exemplary an example and not a limitation limiting.

10           Figure 1 is a schematic view of a ~~the~~ mechanical solution of an ~~the~~ application machine for the formation of a layering of electronically-interactive material on a support sub-layer, such as in the manufacturing of an electronic circuit board.

15           Figure 2 is a three-dimensional schematic view of a ~~the~~ feeding system of a ~~the~~ distribution unit for the material used for the formation of the said-layering of electronically-interactive material.

            Figure 3 is a view of the distribution unit for the material used for the formation of the ~~said~~-layering of electronically-interactive material.

20           Figure 4 is a schematic front view of the various components of the distribution unit of the system according to the ~~attached claims~~ present invention.

            Figure 5 is a three-dimensional schematic view of a machine which embodies the system for the formation of a layering of electronically-interactive material; according to this invention.

Detailed description of the solution illustrated in the drawings

With reference to Figure 1, ~~it is clear from the characteristics in the~~  
~~claims that~~ the formation of the layer of electronically-interactive material is  
 carried out according to an innovative technique compared with previous  
 technology, as follows:

- 5    - A support (a board of plastic material S, for example) is positioned on a  
 mobile bed 2, where the movement of the mobile bed 2 is controlled and  
 programmed by a microprocessor according to a given co-ordinate (Y).
- 10    - Above, there is a distribution unit for punctiform jets of the liquefied  
 material to be deposited (3) in order to form the ~~said~~ layer on the ~~said~~  
 support (S). The distribution unit is programmed to move transversally  
 in a controlled manner by a microprocessor, similar to that of a  
 traditional inkjet printer, with the ~~said~~ distributor having a number of  
 nozzles for the distribution of points the equivalent of pixels, which are  
 able to cover a certain area equal to  $n \times d$ , where "n" is the number of  
 15    nozzles which are sprayed in line, and "d" is the distance along the line  
 from one nozzle to another, with a layout, for example, along three lines  
 alternately disposed, 1, 2, 3, for a length of 70mm.
- 20    - The forward progress of the underlying support is in steps of 70mm, up  
 to the complete deposit on the surface of the support in question (S).

20    Figure 2 illustrates ~~a the~~ feeding system of the liquefied material (which may  
 be ~~coloured~~ colored, for example, with conductive powder in suspension in  
 the various containers with a respective electro-induced vibration mixer),  
 which comes from a main container 4 with a cover 40 for loading-40.

25    This container has two tubes for the liquefied material: one is ~~a the~~  
 feed line 41 for feeding by means of a solenoid check valve 410 to a

pressure equalizer ~~equaliser~~ and regulator 5 which will be described in detail in the successive ~~function~~ operation, and the other is a return line 71 from a recovery and recycling container of the same liquefied material 7, the function of which will be described later.

5            In this description, the liquefied material means the ~~saïd-material~~ used for the formation of the ~~saïd-layering~~ of electronically-interactive material used to cover the ~~saïd-support~~ or plate of plastic material "S".

             From the bottom of the ~~saïd-pressure~~ equalizer ~~equaliser~~ and regulator 5, there is a pipe 53 which leads to the bottom of a buffer 6 with an  
 10    upper air chamber "A". The liquid to be deposited settles in the lower part "L", where there are pipes which take it to a ~~the~~ nozzle chamber forming a ~~the~~ distribution means for point-type sprays (31) which forms the ~~saïd~~ distributor. The ~~saïd~~ buffer 6 is suitable, therefore, to contain the ~~saïd~~ liquefied electronically-interactive material "L", while the upper air chamber  
 15    "A" acts as a pressure compensator, that is, as a damper, ~~being~~ able to increase or reduce according to the emission and/or consumption of the liquefied material and, therefore, increase or reduce the request for material from the intermediate pressure equalizer ~~equaliser~~ and regulator container (5).

20            The ~~saïd~~ buffer 6 is positioned above and is joined to the distribution means for point-type sprays (31). Also, the ~~saïd-pressure~~ equalizer ~~equaliser~~ and regulator 5 may move upwards and downwards parallel to the up and down movement of the ~~saïd~~ distribution means for point-type sprays (31) and the ~~saïd~~ buffer 6 on guide carriages 52, ~~and~~. The pressure equalizer and  
 25    regulator 5 may also be finely regulated in height with respect to the height



of the ~~said~~-buffer (6) and the ~~said~~-distribution means for point-type sprays (31) so that it may regulate the pressure to be either higher or lower according to ~~for~~ the difference in level and according to the principle of communicating vessels, with the pressure variation induced by impeding the principle of communicating vessels by means of the presence of the ~~said~~-air chamber "A" in the ~~said~~-buffer 6. In this way, by being able to regulate the pressure to be either higher or lower according to the programmed value by means of ~~the~~-computer control with a micro-processor, the highest functionality is achieved.

10 It thus becomes possible to comply to the following conditions according to the program:

- i., start distribution at the start of the transversal movement according to "X" with a distribution pressure p1;
- ii., vary the ~~said~~-pressure immediately afterwards to a the-value p2, where p2 < p1, with repetition of the cycle for every transversal movement of distribution-deposit "X"; and
- iii., vary the distribution again to a value of p3, so that p3 > p1, for a cleaning operation of ~~the~~-filters where the ~~said~~-material passes; so as to carry out a maintenance cycle during a non-operational phase, that is, when material is
- 20 not being deposited according to "i" or "ii".

According to Figure 4 which schematically illustrates the distribution unit 3, we can see that, at the side of the ~~said~~-distribution means for point-type sprays (31), on one side there is an ultra-violet light transmitter 34 which has the function of polymerizing ~~polymerising~~ the fluid distributed on the surface of the support material (S), with the liquid being distributed in a

25

form to be ~~polymerized~~ polymerised due to the action of ultra-violet rays;  
~~and on.~~ On the opposite side there is an ultra-sonic distance sensor 32 which  
 detects the distance of the underlying support (S) from the depositing bed  
 and transmits the respective data to the processor so that, according to the  
 5 program, it brings it closer, takes it further away or holds it at the same  
 distance.

There is also a television camera 33 to the side, to view the surface  
 of the support zone subject to the deposit in question, both for the fine  
 tuning by means of reference points according to a well known technique;  
 10 and for checking the correct distribution, depositing, regularity of the  
 covering, etc.

According to Figure 5, we can see a three-dimensional schematic  
 view of a machine which includes all of this equipment in order to use the  
 system ~~according to the characteristics in the claims.~~ The machine has a base  
 15 1 which includes the electric and computerized ~~computerised~~ electronic  
 system, with a control computer ~~therefore~~ therefor, and which also has the  
 function of supporting the mobile bed 2 which is movable longitudinally by  
 means of worm screws 20, the rotation of which is controlled by the ~~said~~  
 computer. The support panel "S", such as an electronic circuit board (in  
 20 plastic material, for example), on which the layer of electronically-  
 interactive material is to be formed, is placed on the ~~said~~-bed.

A further transversal worm screw 30, the rotation of which is  
 controlled by the ~~said~~-computer, is positioned above the ~~said~~-mobile bed (2).  
 This transversal screw 30 carries the ~~said~~-distribution unit 3 as described ~~3~~.

The system for feeding the liquefied material is connected laterally to the ~~said~~-distribution unit (3).

The feeding system is carried out, as already stated, in a controlled way by means of the ~~said~~-three containers 4, 5 and 6 with their respective  
 5 piping.

At the back, block 340 forms the ultra-violet ray generator which feeds the ~~said~~-ultra-violet ray transmitter 34.

Going back to the ~~said~~-main feed chamber 4 and cover 40, it must be made clear that it also has the return pipe 71 which comes from a lateral tank  
 10 7 fixed at the side of the mobile bed 2, in order to be covered during the washing phase of the ~~said~~-distribution means for point-type sprays (31) during the non-operational phase of washing the filter with a higher pressure  
 p2 p3.

In this case, the fluid which is fed for the washing phase, which is  
 15 neither polluted or damaged, is recovered by the ~~said~~-tank from below the nozzles in the ~~said~~-distributor means for point-type sprays (31), and taken by means of the ~~said~~-pipe 71 to the ~~said~~-main container 4.

All three of the containers 4, 5 and 6 have a vibration unit inside to keep the liquid constantly in motion during the feeding operation, in order to  
 20 keep the suspended substance, which is heavier than the liquid, uniformly distributed (eg. copper powder for the conductivity of the material, pigments for the insulating material, etc.)

The ultra-violet (UV) ray device 34 advantageously works at room temperature and, because it heats up, it is cooled down at the same time  
 25 according to a controlled temperature by suitable equipment which is part of

the machine. In this way, the ~~polymerization~~ ~~polymerisation~~ of the deposited material is carried out at room temperature without damaging the material or the support, and without compromising the functionality of the entire depositing unit (3).

- 5           The distribution nozzles for the material to be polymerized ~~polymerised~~ by means of the distribution unit for point-type sprays (31) are advantageously conformed to supply punctiform (pixel-by-pixel) sprays equal to 1 pixel at a time in logical-succesione succession.

          There are one or more rows of distribution nozzles. More rows of  
10 nozzles or distributors may be foreseen in order to deposit different materials.

An example of different materials could be the following, for example:

- conductive material;
- insulating material; and
- 15 - covering or protective material.

A further advantage is that the system includes the activation or shut-down of the ~~said—~~ultra-violet ray polymerization ~~polymerisation—~~device (34) in a controlled way to make the following possible:

- 20 - the direct polymerization ~~polymerisation—~~immediately after being deposited, or
- to fix it.

## Abstract

A machine controlled by a computer for depositing a liquefied electronically-interactive material on a sheet or support card, ~~which~~ includes: a base (1) to support ~~a~~ the mobile bed (2) which is moved

5 longitudinally (Y) ~~by means of~~ a worm screw (20) whose movement is controlled by a computer; and which supports for the support and fixes ~~fixing of the said~~ support sheet or card "S" on which the layer of electronically-interactive material is to be formed; ~~a~~ A bridge above the

~~said base~~ has ~~with~~ a transversal shaft (30) which also has a worm screw and

10 whose movement is also controlled by the ~~said computer, in which the~~ The transversal shaft (30) moves the ~~said~~ distribution unit for the electronically-interactive material to be deposited (3) in an orthogonal direction (X).